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Zero Retries is an independent newsletter promoting technological innovation that is occurring in Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Radios are computers - with antennas! Now in its fourth year of publication, with 2300+ subscribers.

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Steve Stroh N8GNJ, Editor

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Web version of this issue - https://www.zeroretries.org/p/zero-retries-0181

Request To Send

Commentary by Editor Steve Stroh N8GNJ

Paid Subscribers Update

My thanks to **Prefers to Remain Anonymous 60** for *upgrading* from a free subscriber to Zero Retries to an **Annual Paid Subscriber** this past week! PTRA 60 included this nice note:

> I enjoy reading about advances and cool ideas in digital ham radio and satellites. Your blog is definitely worth supporting!

My thanks to **Prefers to Remain Anonymous 59** for becoming an **Annual Paid Subscriber** to Zero Retries this past week! (I sent PtRA 59 an email Thank You note, but their @arrl.net email address bounced.)

Financial support from Zero Retries readers is a significant vote of support for the continued publication of Zero Retries.

Nice Mention of Zero Retries on Facebook

Zero Retries Pseudostaffer and AREDN Ambassador Orb Beach W6BI wrote this nice blurb recently in the Facebook AREDN Group:

> While not strictly oriented towards AREDN, the Zero Retries Newsletter is worth subscribing to:
>
> ***Zero Retries is an independent newsletter promoting technological innovation that is occurring in Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Radios are computers - with antennas! Now in its fourth year of publication, with 2300+ subscribers.***
>
> Check it out!

That explains the nice bump of new Zero Retries email subscribers in the past week. Thanks very much W6BI!

Focused Foundations for Amateur Radio Technologies / Projects

In ZR > BEACON in this issue, you'll read that the M17 Foundation has been formed.

This trend of creating focused, formal organizations to promote promising Amateur Radio technologies that have achieved some signifiant momentum and scale is, I think, the wave of the future.

"Unfocused" organizations (I won't name names) formed with "broad, unspecific" mandates, are I think failing, or doomed to fail, because they can't maintain a focus that promotes interest, momentum, and energy. For example, if you want to be involved in moving APRS forward, there's now one place to pay attention to and one place to go to try to get involved - APRS Foundation.

Now, ditto, M17 Foundation - there's now one place to pay attention to and one place to go to try to get involved - M17 Foundation.

That's not to say that "just go form a foundation" is a panacea for a promising new Amateur Radio activity or interest or technology. Maintaining a foundation is *work and a huge commitment for the principals involved*, but I think it helps a lot that such organizations have a real focus and thus there's a simple test for what an organization should be doing - is this "new thing" *within the scope of our organization*?

I can imagine a number of other candidates for focused organizations such as MMDVM, FreeDV, a group for coalescing Amateur Radio standards, a group for a large technical conference, a group focused on an Amateur Radio GEO satellite or payload in the Western hemisphere, and perhaps even an Amateur Radio media organization that melds YouTube, social media, newsletters, podcasts, and even a magazine[1].

HamSCI 2025 Announcement

Ryan Tolboom N2BP via email:

Image courtesy of Ham

I just wanted to reach out to you to let you know that the HamSCI 2025 conference will be held on March 14-15th this year at NJIT in Newark, NJ. It may be of some interest to your subscribers and I'm on the organizing committee so I thought I'd let you know as soon as we had some promotional material prepared.

Normally I'd put such an announcement in the ZR > BEACON section, but N2BP and HamSCI is the first (and to date only) organization that has reached out to me about their 2025 events, thus it deserves something of a premium mention. I'll be updating the Zero Retries Guide to Zero Retries Interesting Events for 2025 in the next few weeks.

Folks that have attended past HamSCI conferences have told me that HamSCI conferences have much of the feel and energy of a Digital Communications Conference, but more so because of the large presence of university students. I probably won't be able to make it to HamSCI 2025, but perhaps I'll be able to attend in 2026.

My Thanks to N2BP for letting me know about HamSCI 2025.

Television Repeaters Versus *Data* Repeaters

I confess that I'm of two minds when I feature articles in Zero Retries about Amateur Radio Television, especially ATV repeaters. One perspective is what they are doing, especially the current practice of using *Digital* Amateur Television technology, is deeply technical and thus Zero Retries Interesting.

But my other perspective is why create yet another "*dedicated* mode system" when a more usable approach is to create a "bit pipe" repeater that can be used for things other than (digital) television?

I engaged with Jim Andrews KH6HTV, Editor of Amateur Television Journal briefly about this issue and he turned my question back on me and said in essence, “Why don’t you data folks just tunnel data over a digital television system?”. That was a fair point, given that there are likely more Amateur Radio Digital Television repeaters on the air than repeaters dedicated to data. Or perhaps “video over a data repeater” is something that has to be proven out and demonstrated to be taken seriously by the video folks.

Have a great weekend, all of you co-conspirators in Zero Retries Interesting Amateur Radio activities!

Steve N8GNJ

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Lynn Deffenbaugh KJ4ERJ is a Silent Keyboard

By Steve Stroh N8GNJ

Posted to the APRS email list by Jeff Hochberg W4JEW, President of APRS Foundation on 2024-12-02:

> Lynn - KJ4ERJ - author of APRSIS32/CE, passed away. We don't have any more information right now.
>
> …
>
> He was one of the nicest people I've ever met, and I considered him a great friend!
>
> The APRS Foundation and the APRS community worldwide know of Lynn's contributions to ham radio. His mark will never be forgotten.

I know of KJ4ERJ only by reputation, but he was very well-respected in the APRS community and was a one of the founding Board of Directors of the APRS Foundation. KJ4ERJ was the author of one of the most capable APRS applications - APRSISCE/32:

> APRSISCE/32 is a sophisticated Automatic Packet Reporting System (APRS) client, which unlike many other clients aims to accurately implement the entire APRS specification. And make allowances for those clients that do not.
>
> The software also includes many advanced features, as alluded to in the feature list above.
>
> APRSISCE/32 is under active development, and the development version is regularly updated and also freely available, New users are encouraged to use the general release version until they are familiar with the software.
>
> …
>
> APRSISCE/32 is an advanced Automatic Packet Reporting System (APRS) Client for Amateur Radio, written for Windows (x86 and x64) and Windows Mobile (CE). It will also run on Linux and Mac OS under WINE, as well as other virtual machines. It does *NOT* run on any Windows CE 5 or 6 GPS unit as of 2012/04/11.
>
> APRSISCE/32 can be configured to run connected directly to the APRS-IS via an internet connection, as well as connected to the APRS-RF network via software modems such as UZ7HO Sound Modem, Dire Wolf or AGWPE, using a TNC, or one of the APRS capable Radios including the Kenwood TH-D72/TM-D710 and Yaesu FTM-350.

Here is a presentation KJ4ERJ did on APRSISCE/32 in 2022:

In Zero Retries 0167 - A Conversation with Jeff Hochberg W4JEW - Part 1 - the Appalachian Trail Golden Packet 2024 Event, KJ4ERJ was mentioned prominently as part of the ATGP community in the new position of “Shack Potato”:

> As part of the ongoing refinement (research) in the quest of a routinely successful ATGP, there is a new position amongst the participants of ATGP - "Shack Potato". In 2024 Lynn Deffenbaugh KJ4ERJ assumed this role, which monitors and records the entire event via the Internet using the extensive APRS Internet Server (APRS-IS) connectivity. The idea is that by not being an on-air participant, but monitoring and recording the entire event via APRS-IS with better computers and connectivity, a better after-event evaluation can be conducted.

I was unable to find anything else online about KJ4ERJ's passing. I contacted W4JEW for more information about KJ4ERJ, and was told that the APRS Foundation is working on their own remembrance to be published sometime in the future.

As I told W4JEW:

> We can all take some comfort that at least Lynn got to see the emergence of APRS Foundation and thus a good start towards re-establishing APRS as a vital part of Amateur Radio.

73, KJ4ERJ from N8GNJ and the APRS community. *You are missed*.

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75% of Technician Licensees Inactive After One Year?

By Steve Stroh N8GNJ

A statement in the ARRL Annual Report for 2023 :

> *…three-quarters of Technician-class licensees (who make up 51% of amateur radio operators) are inactive 1 year after getting licensed…*

While discussing this issue risks "discussing Amateur Radio politics and / or the ARRL" which seems to irritate some Zero Retries readers, I feel this situation, *if* true, *if* stated accurately, *is directly relevant* to the mission of Zero Retries:

Promote technological innovation that is occurring in Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology.

I confess I missed that statement in *my* quick perusal of the 2023 ARRL Report, until Jeff Davis KE9V highlighted it in his ke9v.net blog:

> **Retention Limited**
>
> *December 4, 2024*
>
> While perusing the 2023 ARRL Annual Report I was struck by something President Rick Roderick, K5UR wrote [in the **A Message from the President** section]:
>
> *According to an ARRL study, three-quarters of Technician-class licensees (who make up 51% of amateur radio operators) are inactive 1 year after getting licensed…*
>
> I knew retention was a big issue limiting the growth of amateur radio, but I had no idea it was this bad. I mean sure, some amount of someone getting into a hobby and only to discover *it isn't for them* is to be expected. But 75% is an awfully big number. It's like trying to fill a swimming pool with a four-foot hole in it with a bucket and it seems to me this deserves more attention. There is little point in focusing on other aspects of recruitment without fixing this first. It's tossing good money after bad, uselessly burning volunteer hours that could be better directed elsewhere.
>
> **It points directly to the failure of the current Technician license structure.** The time has come to re-shape this class to include more privileges to give new licensees something else to sample before they head for the exits. Time is much too valuable to waste on futile pursuits.

First… There were no details provided about this "ARRL Study". I'm not contesting that there was some kind of study conducted by the ARRL, or the conclusions of such a study, *as far as they went*. But I don't recall such an ARRL study being made public for more detailed reading by us ARRL members. But as I explained in two recent articles - in **Zero Retries 0173** - ARRL's Dismissive Arrogance re: Technician Class Amateur Radio Operators and in **Zero Retries 0174** - A Difference of Perspective, I don't necessarily agree with the ARRL's conclusions about its assessment of whether new Amateur Radio Operators are "active" or "not active".

TL;DR - For example, *would ARRL recognize a new Amateur Radio Operator as "active" if their sole activity in Amateur Radio is data communications on microwave frequencies such as building and operating AREDN networks?*

That said, I agree with KE9V that "75%…" is a big number, even if I quibble with ARRL's definitions of "active". If that statistic is even half-accurate, it is *the* major problem for the future of Amateur Radio.

I also agree with KE9V that the premise behind the current US Amateur Radio licensing structure simply fails in the technological realities of the 2020s. The current Technician / General / Extra tiers of Amateur Radio licensing was predicated on the expectation that Amateur Radio Operators would want to "advance" from the entry level license (Technician) to take be able to operate all modes on all of the Amateur Radio HF bands (General) and have semi-exclusive access to small portions of the HF bands and some "sexier" callsigns (Extra) . In reality… those incentives just aren't that compelling to new Amateur Radio Operators in the 2020s. VHF / UHF / Microwave / Space is challenge enough for them[2], and more in keeping with the issues of putting up large outdoor antennas for HF operations, acquiring the "tribal knowledge" needed to operate on the HF bands, etc.

Also in my opinion is that part of that issue with is that a lot of new Amateur Radio Operators were "told a compelling story" - that if they got their Technician Amateur Radio license and a basic VHF / UHF portable radio, they would be "prepared for emergency communications via Amateur Radio" in a widespread emergency or disaster. When they did their part - got licensed, purchased a VHF / UHF portable radio, and then began to try to use it, *their experience was frustrating and disappointing*. Beginning with getting their "inscrutable"[3] inexpensive new portable radio configured for local repeaters, or the inevitable bad experience of using a "rubber duck" antenna indoors to attempt to access a VHF / UHF repeater[4], or just the general lack of support

from their immediate Amateur Radio community, such as “now you need to study for your *General* license”.

But I think that another, *big* part of the problem “Technicians going inactive” (again, if actually true, rather than a difference of definitions) is the disappointing experience of new Amateur Radio Operators that are interested in data communications with the *lack of data communications infrastructure*, other than a smattering of Winlink stations on VHF / UHF and APRS digipeaters operating at 1200 bps AFSK on 144.39 MHz[5]. Using simplex communications by a new Amateur Radio operator *can be a frustrating experience* unless you have another station in close proximity (that is cooperative and supportive). Given that repeaters are generally designed to enable low power operations, mobile, and terrain issues to communicate reliably, it’s unfortunate that there are very few VHF / UHF repeaters that support data communications… and a general lack recognition of the importance of data communications on VHF / UHF repeaters by Amateur Radio as a whole.

If current Amateur Radio Operators (and especially repeater owners) don’t know about how much better data communications can be using VHF / UHF repeaters, then they can’t tell and encourage the new Amateur Radio Operators about such things.

The lack of Amateur Radio data repeaters is partly an issue of lack of evangelism and lack of effective education. I will be making it a “Zero Retries Campaign” to provide such evangelism and education about the utility of, and the need for data repeaters. For some background reading on this issue, see **Zero Retries 0179** - Explaining the Use Case for Data Over Repeater - Part 1, and **Explaining the Use Case for Data Over Repeater - Part 2** later in this issue of Zero Retries.

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Explaining the Use Case for Data Over Repeater - Part 2

By Steve Stroh N8GNJ

*Continuation of a series begun in **Zero Retries 0179** - Explaining the Use Case for Data Over Repeater - Part 1.*

Begin With The End In Mind

One of the primary tenets in the great book **7 Habits of Highly Effective People** that has really stuck with me in the decades since I first read it is:

Begin with the End In Mind

I’ve found that simple advice often helps me when I’m stuck in “process” - *how do you want this situation to end up*? Once you can imagine what you want to see at the end of the “process”, next steps and an overall plan sometimes become clear (but not always), but at least you have an idea of what to tackle next in the “process of getting to “The End”.

Thus, what follows is my current thinking of “The End In Mind” with regard to a potential long term project of advocating that Amateur Repeaters be reimagined for data communications, either as dual use with voice, or repurposed to be primarily for data use.

The Current Generation is “Data First”

One of the “barriers to entry” for getting Amateur Radio operators of the current generation on the air and active within Amateur Radio is that they prefer data communications… text[6]… to voice communications for their casual communications.

Just as modern society has migrated to data / text communications for much of its typical communications - text messages, sharing photos, email, social media (both text and short video), Amateur Radio has begun to migrate its communications (and experimentation) to data / text. Witness the widespread use of data modes such as WSPR, PSK31, FT8, VARA, FSQ, and APRS, and even EME using JT65. We continue to invent new data modes, most recently LongChat (link is to YouTube demo).

But using data communications on VHF / UHF isn’t very convenient and somewhat expensive because to operate simplex on VHF / UHF requires a station to use powerful radios, external antennas, a reasonably high / clear location, etc. Or, data operations on VHF / UHF are limited to “data light” APRS operation via APRS digipeaters.

Digipeaters Work… Kind Of…

This topic is worthy of a longer discussion, and perhaps a re-examination in this era.

What follows is my perceptions of digipeaters, my memory, my technical knowledge. What I will state in this section is my best understanding of the state of digipeaters, without resorting a thoroughly researched, very long “deep dive”.

Digipeaters are a *reasonable* technology for creating ad-hoc networks for short data bursts such as APRS transmissions of weather data, text messages, position data, etc. However, digipeaters don’t necessarily work well for wide area use, or larger numbers of users, or longer data transfers. In a word, digipeaters were developed as a hack in the early days of packet radio by using a bit of memory in a TNC for receive-buffer-retransmit operations. In short, digipeaters enabled *some* networking in early packet radio. The utility of, and the shortcomings of digipeaters were somewhat overcome by a number of improved types of digipeaters, including Net/ROM / TheNet, TexNet, ROSE, and others I’ve now forgotten[7]. APRS added some optimizations to digipeating such as “digipeat only when it’s a good idea to do so” such as home stations, rarely, and mobile stations, only when moving.

But digipeater operation falls down in a number of ways:

- Digipeaters are generally very simple devices, with limited buffer memory, and thus can accommodate only small amounts of data and short packets. Larger amounts of data or longer packets cause “fragmentation” through the repeater, and reduce throughput.
- If the number of users of a digipeater rises above a certain threshold where too may transmissions exceed the digipeater’s (channel) capacity,
- The Hidden Transmitter (or Node) Problem where some digipeater users cannot receive each other directly, but the digipeater can hear all users

equally well, and thus there are “collisions” when attempting to use the digipeater simultaneously. This cascades into the digipeater and users “backing off”, severely reducing the overall throughput of the channel.

- And, generally, digipeaters are “fossilized” in using 1200 bps Audio Frequency Shift Keying (AFSK).

In Contrast to Digipeaters, Repeaters Work *Well*

Repeaters changed the paradigm of VHF / UHF usage in Amateur Radio, making it easy and effective (and relatively inexpensive) to operate on VHF / UHF and communicate between groups of Amateur Radio Operators in a local area or region.

Repeaters are located in high locations such as skyscrapers, towers, or mountaintops, allowing modest user stations to reliably communicate with each other via the repeater.

An additional advantage of repeater’s high locations is that they allow reliable communications over a wide area.

Repeaters operate in a simultaneous receive / transmit mode8 full duplex by using separate receive and transmit frequencies. When two stations are in communication with each other via the repeater, every user of that repeater knows that the repeater is in use, and thus “collisions” (such as result from Hidden Transmitter / Node Problem) are minimized.

A subtle “feature” of repeaters is that they can act as a “water hole” - a central gathering spot… kind of like a continuous club meeting for a particular group of users. (From other articles in this issue, the water hole effect is especially prominent with Amateur Radio video repeaters.)

Lastly, using a repeater de facto enforces minimal / compatible technical standards of all users, such as requiring a reasonable signal for using the repeater (such as high transmit power or better antennas for users that are farther from the repeater), or use of a particular digital voice technology, or any number of other technical standards.

But… Amateur Radio VHF / UHF repeaters are built for, and used for, almost exclusively voice operations. Yes, there are some data capabilities incorporated into some digital voice systems used in Amateur Radio - see Zero Retries 0179 - “Data capability” on D-Star, System Fusion, DMR, and P25 as explanation of why those systems aren’t very relevant in this era.

The Era of Quiet Repeaters

Simultaneously with the “rise of data communications”, a trend is emerging that Amateur Radio VHF / UHF repeaters are becoming “quiet”. Repeater activity is declining, which becomes a vicious cycle. If a repeater is quiet, there’s less incentive and interest to monitor that repeater for interesting conversations, and the repeater grows even quieter.

Competitive Pressures for Amateur Radio Spectrum

There is also the trend of increasing “competitive pressure” for the VHF / UHF spectrum that Amateur Radio has been allocated, and has been allowed to operate on a shared basis. In this era of almost entirely wireless communications - mobile device networks, Wi-Fi, satellite communications such as Starlink, the competitive pressure is increasing. **This is not fear mongering.** Current examples:

- The Amateur Radio allocation in 3.3 - 3.5 GHz has been eliminated. This was significant because several wide area Amateur Radio microwave networks were built to use this band and thus able operate without interference from unlicensed systems in the 5 GHz band.
- While there are still some segments of the 5 GHz band where Amateur Radio can operate exclusively, the Amateur Radio allocation has been reduced in favor of allocating almost all of the 5 GHz band(s) to unlicensed operation.
- If FCC Docket 24-240 is adopted as proposed, Amateur Radio may lose the effective use of 902-928 MHz because of competitive pressure to reconfigure that band to move Amateur Radio operations, along with all unlicensed operations, into 907-918 MHz.
- Amateur Radio use of the 1240 - 1300 MHz band will inevitably be reduced in the next few years. The primary use for this band, worldwide, is for Global Navigation Satellite System (GNSS) other than the US Global Positioning System (GPS). These new GNSS systems such as Galileo (Europe), GLONASS (Russia), BeiDou (China) are now coming online and using this band and do not want interference from Amateur Radio operations.

Thus there is an increasing imperative to use our Amateur Radio VHF / UHF bands, and demonstrate actual usage, rather than allocating them within Amateur Radio as “allocated” such as repeaters coordinated and built… but provably not widely used when surveys are conducted.

Putting It All Together - The End In Mind

Thus, I posit, that all of the above trends combine to create a multiple “win” situation that quiet repeaters can be repurposed for shared data / voice operation, or in some cases data *mostly* operation. Doing so makes it easier for new Amateur Radio Operators to become active on Amateur Radio data modes in the same way that repeaters make it easier to use VHF / UHF for voice operations, and the repeaters become more widely used, and our Amateur Radio VHF / UHF bands are provably actually being widely used.

A Personal Perspective of Data Over Repeaters

I intend this section not as a “stroll down memory lane”, but instructive background from real world experience.

When I moved to the Seattle area in 1987, I discovered a very active Packet Radio group called the Northwest Packet Radio Association (NAPRA). NAPRA was very active in packet radio - constructing digipeaters and later simplex nodes with links using Net/ROM networking, and user education about getting active in Amateur Radio Packet Radio. Bulletin Boards were commonly used. Years later, some of us in NAPRA became tired of the “petty fiefdoms” of the node owners and BBS sysops. There were endless months of debate about the optimum parameters in the Net/ROM network and the BBS sysops often killed (censored) email from folks they didn’t like, and killed bulletins they didn’t agree with.

Sometime in the early 1990s, when it had been ported to MS-DOS, some of our most technical members discovered KA9Q NOS and began talking it up

amongst ourselves. We first experimented with it over simplex links… and found that TCP/IP over Amateur Radio was fun and very interesting and more capable than "plain" AX.25 packet radio (and nodes, and BBS's). For one thing, we could communicate directly between ourselves using *email*, not messages on a BBS… with a BBS sysop in the middle of our communications. We gradually grew the TCP/IP network with some folks running multiple ports (radios on different bands) and getting more and more capable until eventually we developed the network described in an article I wrote for the 1995 ARRL and TAPR Digital Communications Conference - The Puget Sound Amateur Radio TCP/IP Network (PSARTN). I use the PSARTN terminology in explaining it to a wide audience, but the actual name of the network and group, chosen by the users was WETNET - Washington Experimenters TCP/IP NETwork.

All of the basics of what I'll explain in this section are in that article, and I'm glad I wrote it because it's one of the few surviving bits of documentation of that network - that and one of the 440 MHz repeaters gathering dust in my shop. We were so busy *doing* and experimenting that we just didn't write things down except in email lists of the era… and the server of that list is long defunct and few folks' email archives survived the deaths of the limited life storage mediums of the DOS / *very* early Linux era. So this description will be partially out of memory, and much out of emotion and remembrance of the excitement of that era.

The PSARTN was groundbreaking in its day for combining five significant advances in packet radio in its day:

- At its peak, PSARTN consisted of three 440 MHz repeaters, one 144 MHz repeater, and one 222 MHz repeater, and some simplex channels. There were a few other repeaters that were attempted.
- The 440 and 144 MHz repeaters operated at 9600 bps using a TAPR big regenerative option on the TAPR 9600 bps modems (on a modified TAPR TNC-2 clone).
- The PSARTN used TCP/IP over AX.25. Our subnet in 44Net was 44.24.x.x.
- The repeaters and simplex channels were all networked via routers; initially KA9Q NOS, then JNOS, then Linux on PCs located at the repeaters.
- There was an Internet gateway and we selectively gated messages from usenet and email into and out of PSARTN.

Most of us… the more dedicated, technical folks, operated on the 9600 repeaters using JNOS, and there were a few bleeding edge folks that ran very early versions of Linux. TCP/IP worked well due to the adaptations for slower speed links that KA9Q put into his NOS code.

Admittedly, some of the excitement of the PSARTN was that it was "our own little Internet". We were all able to learn about Internet technology and TCP/IP on our home stations - learning the basics of addressing, routing, and the many, many ways you can misconfigure a router, including creating many, many packet storms (why is my radio transmitting continuously?). Mostly we used fixed IP addresses and static routing, but we experimented with dynamic routing and Dynamic Host Configuration Protocol (DHCP).

Generally, PSARTN worked well. The main issues we had were getting new users up to speed on using and configuring their systems for TCP/IP, tweaking their 9600 systems for correct deviation, and the vagaries of the portion of AX.25 that was the Network Layer and Transport Layer. We also had to contend with slow computers (PCs operating at the original PC's clock speed of 4.77 MHz were commonly in use), setting up KISS in TNCs, bugs in TNCs, and the serial link between the PC and the TNC (had to be faster than 9600 to keep up - upgrading to RS-232 serial cards with 16550 UARTs fixed that issue.

When we were using simplex links with more than two users, it was only partially successful because we had varying modems, radios, transmit delays, hidden transmitters, differing deviation settings, etc. Thus one of the biggest successes of the repeaters operating at 9600 bps bit regeneration is that you could simply start a ping session with another user on the repeater, and just keep adjusting your parameters of your radio or your system. For example, deviation was easy - just adjust for best ping success. If every ping was coming back, your radio was de facto set well enough. And because everyone was working through the same system (the repeater), if you could work one person, you could work everyone who was a user of that repeater.

The three 440 MHz repeaters were regional - one in North Seattle, one on the far East side of the Seattle suburbs, and one far South of Seattle. The 144 MHz repeater was a wide area repeater. With the dispersed coverage of the repeaters, the users generally didn't have try to get into a distant repeater. The 440 repeaters were all connected over a wireline backbone (but some folks had radios on multiple repeaters and could do failover routing).

Once you got your system configured… it just worked. We were able to run email between ourselves, and do multi-user emails (bulletins), and we even had list servers, and the aforementioned Internet gateway. We did all the usual Internet activities of the era - file transfers, pings, email, finger, etc.

Really… ***it… just… worked***. We didn't need any services on the Internet - PSARTN was an Intranet. The Internet connectivity was a convenience, not a necessity.

One of the wildest experiments that we did was a weekend FTP session of some big (for our network) file that was going to take hours. By then our TCP/IP knowledge had advanced to having a sliding window protocol - as long as a transmission got an ack, the sending station would try sending longer and longer packets. For this experiment, two stations were able to access one of the 440 repeaters and the 144 MHz repeaters. They configured the transmitting station to use one repeater, and the receiving station to send the acks via the other repeater. It worked spectacularly well and the sending station transmitted the file. The sending station's repeater got a bit warm, but it was built for continuous duty.

I'm one of the few folks now that remember the PSARTN, and care about it, and the example that it set for how useful repeaters can be for providing a quality experience of data communications over Amateur Radio to new Amateur Radio users who are interested in digital communications. Connecting to PSARTN repeaters was… challenging… and expensive initially. I got connected initially with a 2 watt crystal controlled radio into an expensive run of low loss coax cable into an 11 element beam. Then our group discovered an easy modification for 9600 on surplus GE MVP UHF and VHF radios and then connections into the repeaters were easy.

But the key point - the repeaters worked to connect us all with high speed data communications over Amateur Radio VHF and UHF channels and thus users could have a modest station that worked well.

Operating TCP/IP on the PSARTN was an incredibly satisfying experience, and once enough of us had enough experience in all the gotchas, getting new users onboard was pretty easy because all they had to do was to pick a repeater, get their equipment built up (we gave lots of advice), and get it configured (we had documentation).

One of the primary successes of data communications using repeaters such as the PSARTN was there were very few collisions of two stations trying to use the repeater simultaneously. Every station using a repeater knew, within a few hundred milliseconds, when a repeater was in use and to not transmit so

they wouldn't cause interference. Operating at 9600 bps meant that most transmissions were only a few seconds, thus there was lots of channel capacity on a repeater to accommodate many users.

As for the plaint that repeaters are a single point of failure and encourage a "user" mentality", there is the same issue with voice repeaters (which are, or were, widely used), which is generally answered by redundancy - being able to access other repeaters.

Having experienced the Puget Sound Amateur Radio TCP/IP Network, with the technologies of that era… I continue to be gobsmacked by how much better those directly relevant technologies are now:

- We have full power, frequency agile, 144 / 440 MHz *radios* with flat audio connections (no modifications required) such as the Yaesu FTM-6000R that can easily do 9600 bps (and potentially faster).
- We have high quality audio interfaces such as the Masters Communications DRA50M which connect directly to the most common flat audio connection on radios (the "data / 9600" port using a 6-pin MiniDIN connector).
- We have very fast, very cheap dedicated computers such as the Raspberry Pi series that can be dedicated to Amateur Radio activities.
- We have excellent software modem implementations such as DIRE WOLF that can do things that hardware TNCs of the PSARTN era could never do, such as single bit error correction using bit-flipping.
- We have well-understood implementations of TCP/IP in Linux and many applications.
- We have several implementations of Forward Error Correction, which makes a huge difference in overall reliability of data communications.

Thus I think the time is right to try data communications over Amateur Radio repeaters, and see if we can "recreate the magic" of we users of the PSARTN experienced.

I'm grateful to friends Ren Roderick KJ7B and Michael Sterba KG7HQ who reviewed and commented on a very early draft of the section about the PSARTN.

Leave a comment

Share

ZR > BEACON

By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

M17 Foundation Established

Wojciech Kaczmarski SP5WWP on the brand new **M17 Foundation** website:

> M17 Foundation has been established on December 6th in Warsaw, Poland. From now on, the M17 Project will finally have a solid, legal entity to represent and protect its interests. This is especially important now, when there's growing number of implementations and radio equipment manufacturers, releasing M17-protocol-compatible devices worldwide.

SP5WWP also mentioned in an email to a small group that's been working with him behind the scenes:

> I'll be posting updates there, along LinkedIn, X and Mastodon. This website will have the priority over all the other media. We needed a single place with all the data, under my control. Now we have it.

Note that this new website is different, and differently administered, from the https://m17project.org website which seems to be no longer maintained (at least *my* most requests for access to the News section on that website to maintain that section have gone unanswered).

The formation of M17 Foundation is a triple win, in my opinion.

The first is that significant developments in the M17 Project have suffered from being reported in diffuse media - Reddit, Facebook, Mastodon, LinkedIn, X, etc. rather than one central place where such developments can be looked up and followed to see *the real progress being achieved* with M17.

The second is that M17 Foundation can now act as a central nexus of M17 development, including the significant capability to directly accept grants from, perhaps, ARDC to maintain progress and tackle promising new projects related to M17 such as the OpenHT and Remote Radio Unit.

Third is that having a foundation behind the M17 project adds significant gravitas to what has, to date, been a loose association of developers, contributors, users, and open source technology.

As I did with APRS Foundation, I'll report the early developments of M17 Foundation here in Zero Retries (as I become aware of them) until they are up and running with an independent, dedicated method of periodic communication to their membership and interested parties.

Congratulations and Kudos to SP5WWP on this - it was a lot of work, and it's a significant achievement that will pay huge dividends in the coming years… and significantly advance M17.

Incorporating High Altitude Ballooning in Education

Martin Rothfield W6MRR in an email:

Dr. Michael "Miki" Lustig teaches EE at Cal and is part of the SF-HAB community. He has done ham seminars before. Here's his latest:

https://classes.berkeley.edu/content/2025-spring-eleng-39-001-sem-001

Spring 2025, ELENG 39 001 - SEM 001

Freshman/Sophomore Seminar

High-Altitude Balloon Tracking with Amateur (ham) Radio

Description:

- This is an evolution of previous offering of the “hands on ham radio” seminar.
- Have you ever wondered where party balloons that are released end up at?
- Have you ever wondered how walkie-talkies work?
- Have you ever wondered how GPS works?

…

Wow… Amateur Radio needs more of these kind of informative seminars in high schools and colleges. What a great, low-impact, “hook” for techie-curious students to learn more about Amateur Radio!

My thanks to W6MRR for this Zero Retries Interesting tip!

KM4ACK - Behind the Scenes (of a Parade) - Using flamp and YAAC

Jason Oleham KM4ACK in his 2024-12-03 email newsletter (no web version):

> This is it! The final week before the Christmas Parade happening December 8th. This may be the largest load out that I have put together for an event. I don't think I have used this much gear on a Field Day. Of course the RV will be in the mix. It'll be utilized as my field operating position and parked next to the net control trailer. The RV will be completely off grid. We will use the 200Ah on board battery to power the radios and the solar on top of the RV to keep the batteries topped off. From past experience this outing shouldn't even tax the batteries.
>
> In addition to the two APRS trackers and digipeater that I mentioned last week, two additional radios will be run for digital. The Icom 705 will handle the data (csv files) sent from registration to my position via FLAMP. Once received, net control will be able to download the csv files from a web server that will be running on the same computer that runs FLAMP. Should we have any issues with the web server, there will also be a few USB thumb drives that could be used to transfer the files.
>
> The Kenwood D75 will be the radio supporting [APRS] via YAAC. YAAC will be the application where all of the APRS objects are created and updated. It will also allow us to track the operators supporting the parade and track the parade's progress with packets sent from the trackers.

KM4ACK has a popular YouTube channel (32k+ subscribers). I don’t have any additional context to offer about the event KM4ACK is reporting about, but I found it Zero Retries Interesting that he’s using flamp to transfer files (to multiple users?).

YAAC is “Yet Another APRS Client" that runs in Java and thus is inherently (in theory) a cross platform application.

KM4ACK sounds queued up for a lot of Amateur Radio Packet Radio fun, and a good example of the utility of Amateur Radio Packet Radio technologies!

New Low-Cost HF / VHF / Low UHF RF Power Amplifier Usable for Software Defined Transmitters

Jim Andrews KH6HTV in the ATV Journal Newsletter Issue 177:

> I have been searching for quite some time now for a really low cost RF power amplifier for the 70cm band, similar to those new 24V ones which have shown up in the past year for the 33, 23, & 13cm bands. I finally found one on E-Bay. Not the same, but a similar design. Quite inexpensive also. I paid only $50 including shipping.
>
> The key advertised specs are: 25 MHz - 1.2 GHz, 4 Watts, 40 dB gain, 24 Vdc, SMAs, includes attached heat sink and cooling fan.
>
> The amp arrived today (11/24), so I immediately put it on the test bench to see how it performs. I used my Rigol spectrum analyzer with its tracking generator to test the amplifier up to 1.5 GHz. This is what I found.
>
> 1. The DC idling current was 510 mA at +24Vdc.
> 2. The mid-band S21 gain was 42 dB.
> 3. The -3 dB band-width end points were 3.5 MHz at the low end and 1.17 GHz on the high end.
> 4. The max. saturated RF output power was typically about +37 dBm (5 Watts) from 7 MHz up to the 900 MHz band. This was with an RF input power of about 0 dBm.
> 5. I also tested it on the 23 cm band (1270 MHz). I found it less useful there. The small signal gain was down by -9 dB to around -33 dB. The max. RF output power was also down to +29.5 dBm (0.9 Watts).

6. This amplifier works far better at low frequencies than advertised. Thus, it is very useful on all of the HF ham bands, except for 160 meters. This amplifier with it's high gain, 5 Watt output and broad frequency coverage from the 80 meter band to the 33 cm band would be an ideal candidate for use as the final amplifier in an SDR radio such as the RadioBerry SDR rig, Tom, W0IVJ, showed us in the previous issue #175 (8 Nov.2024).

…

The key Zero Retries Interesting takeaway here is that this amplifier is *finally* a low-cost (US $50!) amplifier *compatible with the very low transmit power output* of Software Defined Transmitters (note the reference to the "RadioBerry SDR rig"). However, there are some potential "gotchas":

- It's an eBay purchase, for all the drama and potential issues of that platform… but you're only at risk for $50 or so.
- It requires 24 volts input (which KH6HTV explains can easily be accommodated with a 12 volt to 24 volt converter).
- The power output up through 450 MHz is "only" 5 watts. But, 5 watts is power level you can do useful things on VHF / UHF, versus the "peanut whistle" transmit power levels of typical Software Defined Transmitters. But the amplifier is "broadband" - thus you can use it for HF (above 25 MHz), and most Zero Retries Interesting, also for bands such as 50-54 MHz (6 meters), 222-225 MHz (1.25 meters), and 420-450 MHz (70 centimeters), and even perhaps the fabled 219-220 MHz band that has been recently discussed by ORI for research and investigation.

I think this amplifier is a natural companion for an Analog Devices ADALM-PLUTO Software Defined Transceiver for low-cost, at least semi-practical experimentation with Software Defined Radio on the Amateur Radio 420-450 MHz band (it doesn't operate below 325 MHz).

See the link in the headline for details on purchasing this amplifier in ATV Journal Issue 177.

Instructions on How to Receive the Western Washington Amateur Television Society [Repeater(s)] with a USB Dongle

Carlos Picoto AD7NP, *also* in the ATV Journal Newsletter Issue 177:

> You can use an Astrometa RTL based dongle, as the one available at the following links. https://www.amazon.com/Dongle-DVB-T2-DVB-T-Digital-Receiver/dp/B07TY5L32G https://www.aliexpress.us/item/3256801626129865.html https://www.aliexpress.us/item/3256806959029656.html
>
> Install the drivers and application from the Astrometa website http://www.astrometa.com.tw/integrated_en.html
>
> …

AD7NP provides a detailed setup procedure (apparently for Windows), only lightly customized for this particular video repeater - it's easily understood how to change it for repeaters.

Most interesting of note is that you can use the very popular VLC app as the viewer:

> **VLC:** Alternatively you can use VLC as the viewer application after you installed the driver and application above. Download the latest version of VLC from https://www.videolan.org/vlc/

This Amateur Radio video stuff, using inexpensive Software Defined Receiver dongles… is getting *very Zero Retries Interesting*. Amateur Radio clubs in big cities are really missing an opportunity by not having an ATV repeater (and running interesting "bulletin" videos) to attract new Amateur Radio Operators with this kind of inexpensive receive option.

Ongoing kudos to Jim Andrews KH6HTV for his interesting, informative and (technical) detailed, and very frequent Amateur Television Journal newsletter explaining Amateur Radio television. Amateur Television Journal is especially notable that that it's free for anyone to subscribe and read. Recommended! I wish there was an equivalent (publicly accessible without a membership fee) for all the "specialized" modes in Amateur Radio such as space / satellites, Software Defined Radio / GNU Radio, low power operation, etc.

KE9V - Weekly BATC Net

Jeff Davis KE9V on his **ke9v.net** blog:

> I enjoy the weekly BATC net that takes place every Thursday afternoon (my time). The net is conducted via QO-100 and is not directly accessible here in North America, however, it is streamed online. Having done this for a few years you begin to feel associated with the group and the individuals and the net chatter becomes more interesting the more you visit. The medium is the message here, it's digital amateur television (DATV) and the ability to showcase a ham shack or highlight a current project, is a big draw for video users.
>
> Whenever the time changes, as it did recently, I seem to miss the first few sessions as it's easy to confuse the start time, and given it's a live event, that's a problem. But recently Ian, VK3QL has been recording the video and making it available (for a few weeks) on his YouTube channel. Being able to *time-shift* the net has been handy for me and I appreciate his efforts.
>
> Full-disclosure, I am a paying member of the British Amateur Television Club and also enjoy the online forum and quarterly publication.

Speaking of receiving Amateur Television…

HOT IRON #127: November, 2024

HOT IRON is a great, informative, newsletter about building homebrew projects for Amateur Radio. The two authors write in a friendly, conversational tone much like Zero Retries, and HI regularly features articles and quick mentions that are Zero Retries Interesting.

This issue of Hot Iron is mostly about power amplifiers, including power amplifiers based on tubes. *Those* are of limited interest to me personally as from unfortunate past experiences, I now have a non-aggression policy towards tube circuits 🤣.

The two authors often give a nice plug to Zero Retries, and I like to do the same for them.

Leave a comment

Share

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out
Join the Fun on Amateur Radio for some pointers.

Zero Retries Frequently Asked Questions (FAQs) — In development 2023-02.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with radio technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to everyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing ***Thanks*** to:

- Tina Stroh KD7WSF for, well, *everything!*
- ***Annual Founding Members*** **who generously support Zero Retries financially:**
  Founding Member 0000 - Steven Davidson K3FZT (Renewed 2024)

  Founding Member 0001 - Randy Smith WU2S (Renewed 2024)
  Founding Member 0002 - Chris Osburn KD7DVD (Renewed 2024)
  Founding Member 0003 - Don Rotolo N2IRZ (Renewed 2024)
  Founding Member 0004 - William Arcand W1WRA (Renewed 2024)
  Founding Member 0006 - Todd Willey KQ4FID (Renewed 2024)
  Founding Member 0007 - Merik Karman VK1DF / VK2MKZ (Renewed 2024 *with two Founding Member subscriptions!*)
  Founding Member 0008 - Prefers to Remain Anonymous 14 (Renewed 2024)
  Founding Member 0009 - Prefers to Remain Anonymous 19
  Founding Member 0011 - Rick Prelinger W6XBE (New 2024)
  Founding Member 0012 - Ryan Tolboom N2BP (New 2024)
- Numerous Annual and Monthly subscribers who also generously support Zero Retries financially!

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- The *most* effective way to support Zero Retries is to simply mention Zero Retries to your co-conspirators that are also interested in knowing more about technological innovation that is occurring in Amateur Radio and encourage them to become a fellow subscriber.
- One particularly effective method of promoting Zero Retries is to add a mention of Zero Retries to your QRZ page (or other web presence) and include a link:

  https://www.zeroretries.org
- If you'd like to financially support Zero Retries, becoming a paid subscriber is *greatly* appreciated and helps offset expenses incurred in publishing Zero Retries. Paid subscriptions for Zero Retries are *entirely optional*, as explained in this special issue of ZR:
  Zero Retries Administrivia - Activating Payment Options.

These blogs and newsletters regularly feature Zero Retries Interesting content:

- Dan Romanchik KB6NU mentions "Zero Retries Interesting" topics so regularly on his blog (that I otherwise wouldn't know about) that I've bestowed on him the honorific of Pseudostaffer.
- Jeff Davis KE9V also mentions "Zero Retries Interesting" topics so regularly on his blog (that I otherwise wouldn't know about) that I've bestowed on him the honorific of Pseudostaffer.
- Amateur Radio Weekly by Cale Mooth K4HCK is a weekly anthology of links to interesting Amateur Radio stories that often feature "Zero Retires Interesting" topics.
- Experimental Radio News by Bennet Z. Kobb AK4AV discusses (in detail) Experimental (Part 5) licenses issued by the US FCC. It's a *must-read-now* for me!
- RTL-SDR Blog - *Excellent* coverage of Software Defined Radio units.
- TAPR Packet Status Register has been published continuously since 1982.
- Hot Iron - The Journal of the Constructor's Club is a delightful quarterly newsletter.

- Other Substack Amateur Radio newsletters recommended by Zero Retries.

These YouTube channels regularly feature Zero Retries Interesting content:

- HB9BLA Wireless by Andreas Spiess HB9BLA
- KM6LYW Radio by Craig Lamparter KM6LYW (home of the DigiPi project)
- Modern Ham by Billy Penley KN4MKB
- Tech Minds by Matthew Miller M0DQW

These podcasts regularly feature Zero Retries Interesting content:

- Store and Forward - a podcast about the past and future of amateur radio, by Kay Savetz K6KJN (curator of the Digital Library of Amateur Radio and Communications) and Steve Stroh N8GNJ (Editor of Zero Retries).
- Ham Radio Workbench by George Zafiropoulos KJ6VU (and friends)
- Foundations of Amateur Radio by Onno Benschop VK6FLAB

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Zero Retries / N8GNJ on Mastodon

Zero Retries (N8GNJ) is also on Bluesky — @n8gnj — just click:

Zero Retries / N8GNJ on Bluesky

Email issues of Zero Retries are "instrumented" by Substack to gather basic statistics about opens, clicking links, etc.

More bits from Steve Stroh N8GNJ:

- **SuperPacket blog** — *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- **N8GNJ blog** — *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs in Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ / WRPS598 (He / Him / His)
These bits were handcrafted (by a mere human, not an Artificial Intelligence bot) in beautiful Bellingham (The City of Subdued Excitement), Washington, USA, and linked to the Internet via **Starlink *Satellite* Internet Access**.

2024-12-06

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Footnotes for this Issue

1

I'll posit, once again, that The Communicator published by Surrey Amateur Radio Communications is effectively a magazine of, and for, *this era*. It's online-only, created by volunteer authors and editors, and free to access by all current and prospective Amateur Radio Operators. If it isn't already, it will soon be available in many other languages, much, much better than "Google Translate" thanks to various artificial intelligence translation systems. Imagine such a publication that has hundreds of volunteer authors, from around the world, that's auto translated into native languages. Amateur Radio has always been a "worldwide society", but its media has always been somewhat limited to a specific country or language… but that doesn't need to be the case in this era.

2

As it was for me, for decades, until the evolution of modern, interesting data communications modes on the Amateur Radio HF bands made HF interesting for me.

3

Generally, inexpensive portable radios made in China that were not designed to be programmed for local channel settings (repeaters, local simplex channels, etc.) from the front panel of the radio. This in contrast with (even inexpensive) portable radios made by major Japanese Amateur Radio manufacturers that *can* be fully programmed for local channel settings from the front panel (admittedly slowly, with lots of consultation from the generally well-written manual), but can *optionally* be programmed from a host computer.

4

There just isn't any recognition within the general public of the, by now, *trillions of dollars of overall investment* in radio technology, computer technology, network infrastructure, the incredible sophistication of 4G / LTE / 5G mobile network base stations, the density of base stations, microcells, picocells, etc., and the incredible sophistication of mobile telephone technology… that have gone into making your "pocket computer" work reliably and fast and (all things considered) inexpensively to bring you the latest in funny cat videos. In comparison, the portable VHF / UHF Amateur Radio that a new Amateur Radio Operator attempts to use, even with a newer technology such as DMR, is "primitive" in comparison, especially in reliable performance. There's just no comparison new Amateur Radio Operators can certainly tell that there is a vast difference in reliable performance between their VHF / UHF portable radio and their mobile phone… *but they don't know why there is such a difference in reliable performance*. Thus Amateur Radio ends up looking severely limited by comparison.

5

And a few local areas that are trying to diversify APRS communications by using 9600 bps on 440-450 MHz such as 440.800 in the Seattle area - generally using Kenwood TM-D710 series radios. Some users in the Seattle area (I'm no longer among them, having relocated to Bellingham, Washington) were also experimenting with 9600 bps on 223.600 MHz and 144.350 MHz.

6

In this discussion, I'm not distinguishing between text messaging and data communications (transfer of arbitrary data types - email, files, voice, images, etc. If an infrastructure is built for "data", it can easily handle text messaging, thus I think that's the preferred goal, rather than networks that are built for text messaging.

7

Such past approaches, that were attempted, but didn't necessarily work out / catch on / were too expensive, required custom expensive hardware, etc. is one of the primary reasons why I continue to advocate for the Digital Library of Amateur Radio & Communications - DLARC. A long term project I hope to attempt in 2025 is a study of the various approaches to packet radio networking, and why they failed (or just faded out) and what their relative advantages / approaches were. In the 2020s we have far better technologies from when those systems were attempted, and perhaps we can bring together a unique new, powerful method of data networking in Amateur Radio that takes full advantage of our spectrum, software defined radio, cheap processors, etc. That's only possible to do in this era because all of the relevant publications about those systems can now be accessed within DLARC.

8

Many refer to this as "Full Duplex" though I consider that an incorrect characterization given the way a repeater can only relay one transmission at a time. True full duplex (such as telephone usage) means that both parties in communication can transmit and receive simultaneously.